LINETRAXX® RCMB300 series

AC/DC sensitive residual current monitoring modules

with an integrated measuring current transformer

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Device features

- Continuous residual current monitoring in compliance with DGUV Vorschrift 3 (German Social Accident Insurance Regulation 3)
- Easy DIN rail or screw mounting
- RS-485 interface with Modbus RTU (reading out measured values/setting parameters)
- Integrated switching outputs with two changeover contacts K1 and K2 (galvanically isolated)
- Frequency range DC…100 kHz
- Combined test and reset button
- Multicolour LED indicating operation, exceeded response value, disturbances and status messages
- AC/DC sensitive type B measured value acquisition acc. to IEC 60755
- AC/DC sensitive type B+ measured value acquisition acc. to VDE 0664-400
- The AC and DC components as well as the r.m.s. value of the residual current can be evaluated separately
- Exchangeable electronic enclosure without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
- Insensitive to load currents due to full magnetic shield (CTBC20P…210P only)
- Connection monitoring of the measuring current transformer with cyclical test current
- Use of the RCMB301 for all CTBC… measuring current transformer sizes
- Supply voltage DC 24 V

Approvals and certifications

Product description

The residual current monitoring modules of the RCMB300 series are intended for measuring AC and DC fault currents in earthed systems (TN and TT systems). The modules are able to measure residual currents up to I_{Δ} = 20 A in a frequency range of DC…100 kHz.

Two separately adjustable response values allow a distinction to be made between prewarning and alarm. When the response value $I_{\Delta n2}$ (alarm) is reached, the output relays K1 and K2 switch.

The modules feature an RS-485 interface with Modbus RTU which can be used to transfer measured values and alarm values. Setting parameters is also possible via this interface.

The residual current monitoring modules each consist of the RCMB301 evaluation electronics and a CTBC20(P)…210(P) series measuring current transformer core.
To assemble a complete module, both the electronics and a measuring current transformer core are required; if ordered separately, these two components must then be plugged together and calibrated during commissioning.

The measuring current transformer cores of the CTBC20P…210P series feature an integrated magnetic shield and are suitable for applications with high load currents or inrush currents.

Function

Residual current $I_{\Delta n}$

The residual current monitoring module measures both AC and DC currents. Tripping takes place based on this determined r.m.s. value. When the response value set for $I_{\Delta n2}$ (alarm) is exceeded by a residual current, the output relay K2 switches and the LED lights up red.

By using the RCMB module, the individual components of the residual current (AC component, DC component) and the r.m.s. value can be evaluated separately. In addition, main alarm and prewarning can be set for the individual components and can be assigned to the two relays. The response values for the different components should be within the same measuring range.

When the fault memory is enabled, pressing and holding the "T" button between 1.5 and 5 s resets the device after the cause of the tripping has been eliminated.

The RCMB module automatically checks the measuring current transformer and the function of the residual current measurement cyclically.

Test

Press the "T" button or the external test button for 5…10 s to start the manual self test of the device.

RS-485 interface

The RS-485 interface enables both reading out the measured values and setting the parameters of the device via Modbus RTU. Furthermore, a test can be triggered via the bus.

Variants

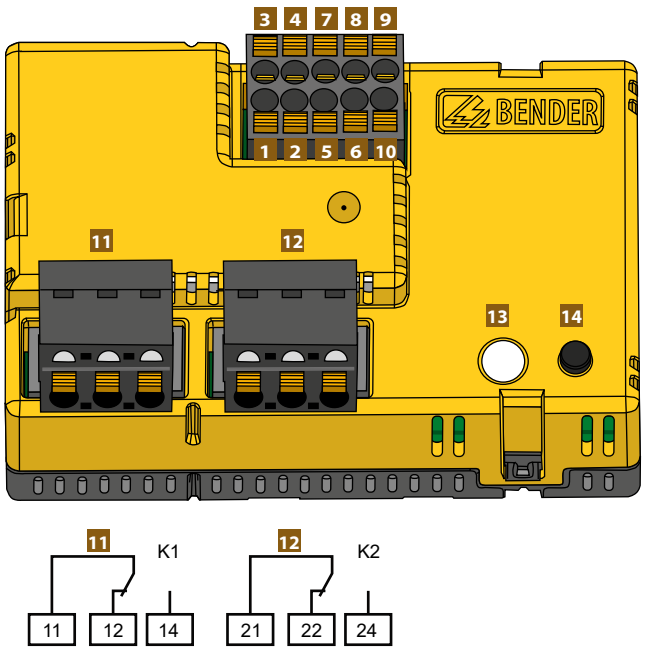
Electronic modules

- **RCMB301**
  Type B modular residual current module acc. to IEC 60755

Measuring current transformer cores

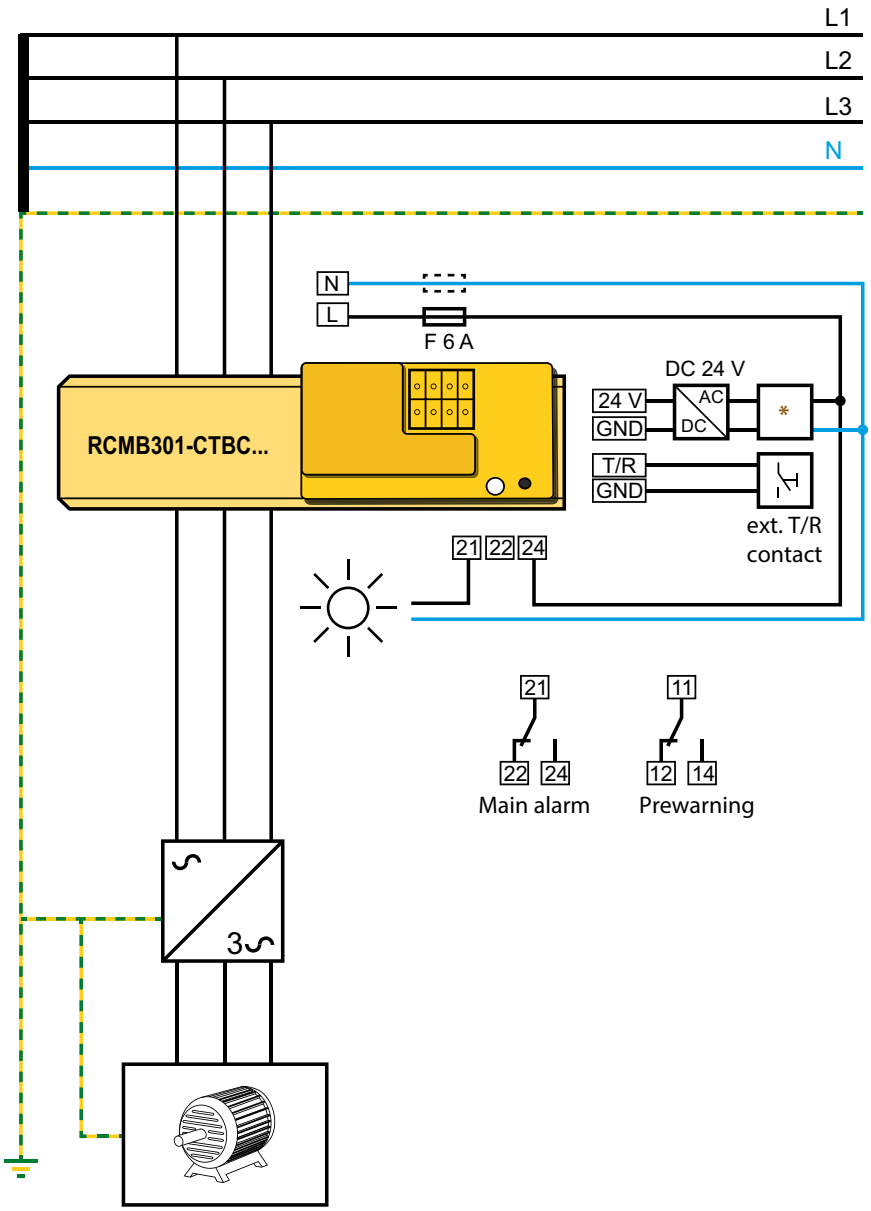
- **CTBC20**
  Measuring current transformer core, internal diameter 20 mm
- **CTBC20P**
  Measuring current transformer core shielded, internal diameter 20 mm
- **CTBC35**
  Measuring current transformer core, internal diameter 35 mm
- **CTBC35P**
  Measuring current transformer core shielded, internal diameter 35 mm
- **CTBC60**
  Measuring current transformer core, internal diameter 60 mm
- **CTBC60P**
  Measuring current transformer core shielded, internal diameter 60 mm
- **CTBC120**
  Measuring current transformer core, internal diameter 120 mm
- **CTBC120P**
  Measuring current transformer core shielded, internal diameter 120 mm
- **CTBC210**
  Measuring current transformer core, internal diameter 210 mm
- **CTBC210P**
  Measuring current transformer core shielded, internal diameter 210 mm

Wiring diagram



1	24 V	Supply voltage U_S
2	GND	
3	D1	Contact feedback
4	DG	
5	T/R	Connection external test/reset
6	GND	
7	A	RS-485 interface
8	B	
9	X1	Terminals for cable bridge for connection of the integrated terminating resistor of the RS-485 interface
10	X2	
11	11, 12, 14	Alarm relay K1
12	21, 22, 24	Alarm relay K2
13	ON/AL	Combined LED: operation "ON" and "Alarm"
14	T	Test and reset button

Wiring diagram RCMB301 (example)

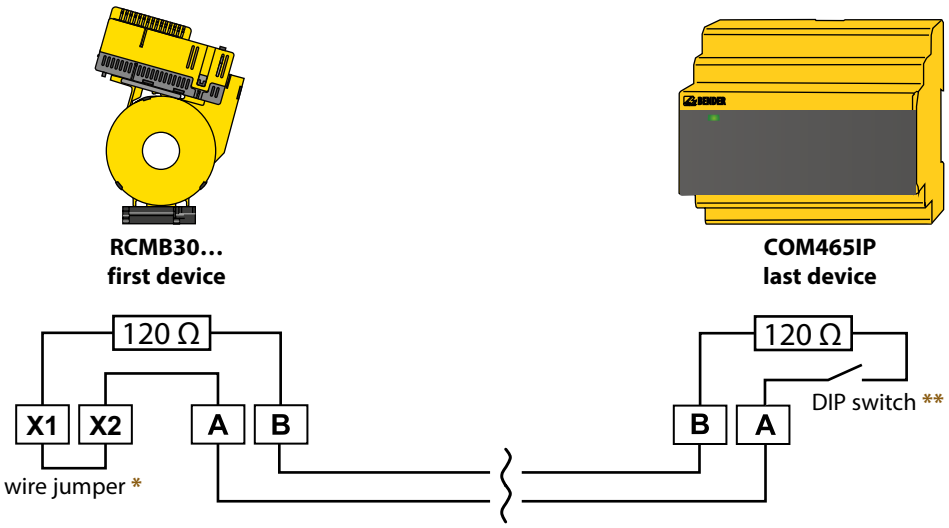


* – The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements.

– The surge protection device must be connected upstream of the power supply unit on the supply side.

– Features of the surge protection device:
Nominal discharge current I_n (8/20 µs): 20 kA
Response time: 25 ns
two-stage: 1 varistor + 1 spark gab
Alternatively, the power supply unit must be connected to a CAT II supply without a surge protection device.

Connection RS-485 interface (Modbus RTU)



* The internal 120 Ω terminating resistor can be connected by using the wire jumper.

** The internal 120 Ω terminating resistor can be connected by means of the DIP switch.

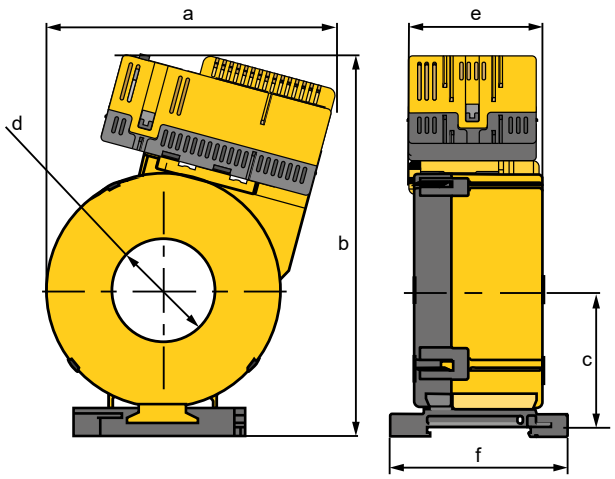
System states: LED and output relays

The LED indicates the system state by means of colours and lighting/flashing. The N/O contacts of relay outputs K1 and K2 have defined switching positions for each system state.

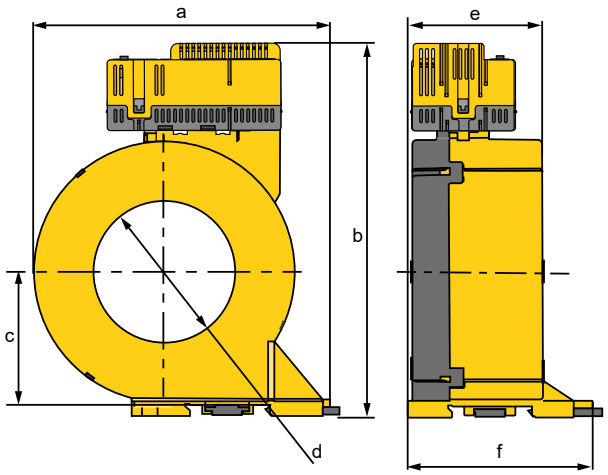
System state	LED		Notes	Changeover contact	
	green (ON)	red (alarm)		K1	K2
Device switched off	off	off	Device is de-energised, no monitoring, no monitoring function	de-energised	de-energised
Normal operating state	lights	off	The device is supplied with the specified voltage and monitors the primary circuit. No residual current flows which would lead to tripping.	energised	energised
Prewarning	lights	Flashes briefly	The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the prewarning.	de-energised	energised
Alarm state	off	lights	The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the alarm.	de-energised	de-energised

Dimension diagrams

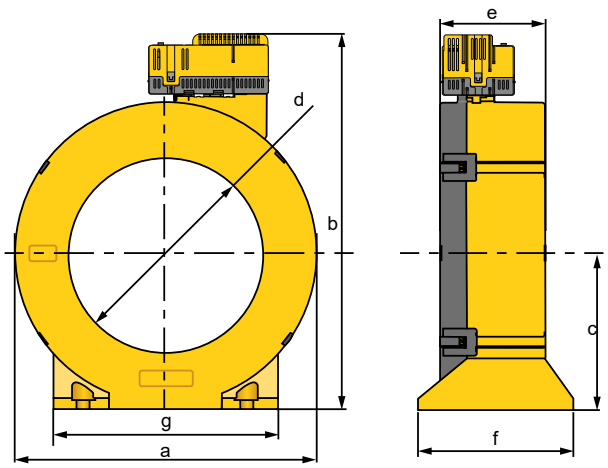
A



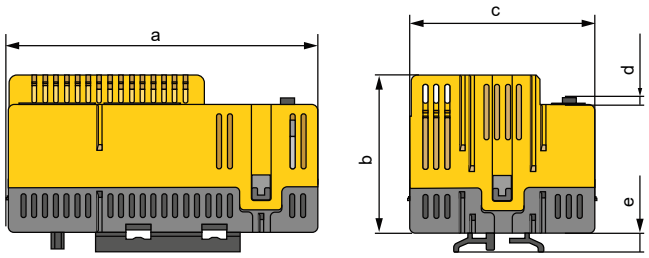
B



C



D

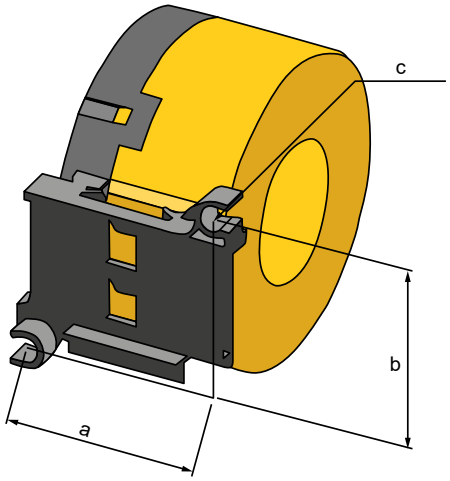


Dimensions (mm)								
	Type	a	b	c	d	e	f	g
A	RCMB301-CTBC20(P)	81	112	37	ø 20	46	60	
	RCMB301-CTBC35(P)	97	130	47	ø 35	46	61	
B	RCMB301-CTBC60(P)	126	158	57	ø 60	56	78	
C	RCMB301-CTBC120(P)	188	232	96	ø 120	65	96	139
	RCMB301-CTBC210(P)	302	346	153	ø 210	67	113	277
D	RCMB301	74	37	44	2	4,6		

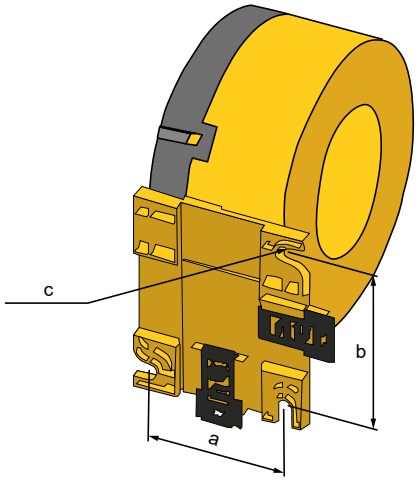
Tolerance: ±0.5 mm

Mountings

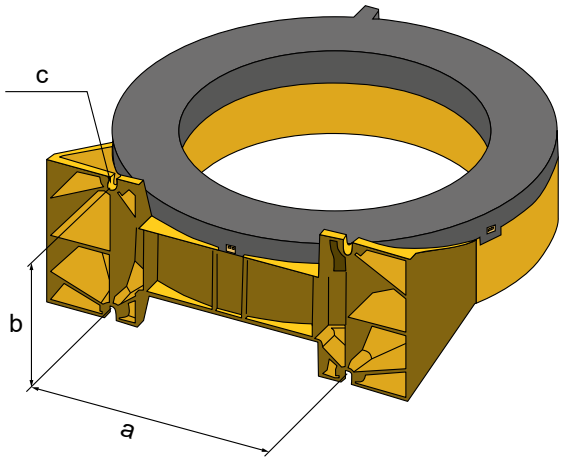
CTBC20(P)/CTBC35(P)



CTBC60(P)



CTBC120(P)/CTBC210(P)



Dimensions (mm)			
Type	a	b	c
CTBC20(P)	31,4	49	2 x ø 5.5
CTBC35(P)	49,8	49	2 x ø 5.5
CTBC60(P)	56	66	3 x ø 6.5
CTBC120(P)	103	81	4 x ø 6.5
CTBC210(P)	180	98	4 x ø 5.5

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	Primary conductors routed through the current transformer
Secondary (IC2)	Terminal block 1 (24 V, GND, T/R, GND, A, B, X1, X2)
Control circuit 1 (IC3)	Terminal block 1 (11,12,14)
Control circuit 2 (IC4)	Terminal block 2 (21,22,24)
Rated insulation voltage	800 V
Overvoltage category	III
Area of application	≤ 2000 m AMSL
Rated impulse voltage:	
IC1((IC2-IC4)	8 kV
IC2/(IC3-IC4)	4 kV
IC3/IC4	4 kV
Rated insulation voltage:	
IC1/(IC2-IC4)	800 V
IC2/(IC3-IC4)	250 V
IC3/IC4	250 V
Pollution degree	2
Safe isolation (reinforced insulation) between:	
IC2/(IC3-IC4)	300 V
Basic insulation between:	
IC1/(I2-IC4)	800 V
IC3/IC4	300 V
Voltage test (routine test) acc. to IEC 61010-1:	
IC2/(IC3-IC4)	AC 2.2 kV
IC3/IC4	AC 2.2 kV

Supply voltage

Supply voltage U_S	DC 24 V
Operating range of U_S	±20 %
Ripple U_S	≤ 1 %
Power consumption	≤ 2.5 W
Inrush current	1.7 A for 1 ms

Measuring circuit

Internal diameter measuring current transformer	see dimension diagrams on page 6
Characteristics according to IEC 62020 and IEC/TR 60755	AC/DC sensitive, type B
Measuring range	5 mA…20 A
Response value $I_{\Delta n}$	30 mA…3 A (freely configurable), (30 mA)*
Prewarning	50…100 % $I_{\Delta n}$ (freely configurable), (60 %)*
Rated current I_n	
CTBC20 at $I_{\Delta n}$ = 30 mA	40 A
CTBC20 at $I_{\Delta n}$ = 300 mA	63 A
CTBC20P	80 A
CTBC35 at $I_{\Delta n}$ = 30 mA	80 A
CTBC35 at $I_{\Delta n}$ = 300 mA	125 A
CTBC35P	160 A
CTBC60 at $I_{\Delta n}$ = 30 mA	160 A
CTBC60 at $I_{\Delta n}$ = 300 mA	250 A
CTBC60P	320 A
CTBC120 at $I_{\Delta n}$ = 100 mA	330 A
CTBC120P at $I_{\Delta n}$ = 100 mA	630 A
CTBC210 at $I_{\Delta n}$ = 300 mA	630 A
CTBC210P at $I_{\Delta n}$ = 100 mA	630 A
CTBC210P at $I_{\Delta n}$ = 300 mA	1000 A
Operating uncertainty	±17.5 %
Relative uncertainty	0…-35 %
Test winding	yes

Possible response values (to be set on the evaluator)

CTBC20, CTBC20P	10 mA…500 mA
CTBC35, CTBC35P, CTUBC60, CTBC60P	30 mA…10 A
CTBC120P, CTBC210P	100 mA…10 A
CTBC120, CTBC210	300 mA…10 A

Time response

Response delay t_{on}	50 ms…60 min (freely configurable), (0 s)*
Start-up delay t_{an}	0 s…60 min (freely configurable), (0 s)*
Delay on release t_{off}	0 s…60 min (freely configurable), (1 s)*
Operating time t_{ae}	
at 1 x $I_{\Delta n}$	≤ 230 ms
at 2 x $I_{\Delta n}$	≤ 180 ms
at 5 x $I_{\Delta n}$	≤ 70 ms
Response time	$t_{an} = t_{ae} + t_{on}$
Recovery time t_b	≤ 1 s

Indication

Multicolour LED	Refer to “System states: LED and output relays” on page 5

Inputs

	T/R, GND

Outputs

Number of changeover contacts	2
Operating principle	N/C or N/O principle (freely configurable), (N/C principle)*
Switching outputs (K1, K2)	250 V, 5 A
Switching capacity	1500 VA/144 W

Contact data acc. to IEC 60947-5-1

Rated operational voltage AC	250 V/250 V
Utilisation category	AC-13/AC-14
Rated operational current AC	5 A/3 A
Rated operational current AC (for UL applications)	3 A/3 A
Rated operational voltage DC	220/110/24 V
Utilisation category	DC12
Rated operational current DC	0.1/0.2/1 A
Minimum current	10 mA at DC 5 V
Electrical endurance, number of cycles	10,000

Environment/EMC

EMC	IEC 62020
Operating temperature	-25…70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K11 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12

Connection

Required terminals are included in the scope of delivery.

Terminal block 1

Manufacturer	Phoenix Contact
Type	DFMC 1.5/5-ST-3.5 BK
The connection conditions of the manufacturer apply.	
Connection properties	
rigid	0.2…1.5 mm² (AWG 24…16)
flexible	0.2…1.5 mm² (AWG 24…16)
with ferrule	0.25…0.75 mm² (AWG 24…19)

Terminal block 2, 3

Manufacturer	Phoenix Contact
Type	FKCVW 2.5/ 3-ST-5.08
The connection conditions of the manufacturer apply.	
Connection capacity	
rigid	0.2…2.5 mm² (AWG 24…13)
flexible	0.2…2.5 mm² (AWG 24…13)
with ferrule	0.25…2.5 mm² (AWG 24…13)

Mounting CTBC…

Screw type	
CTBC20…60(P)	DIN EN ISO 7045 - M5
CTCB120…210(P)	DIN EN ISO 7045 - M6
Washer type	
CTBC20…60(P)	DIN EN ISO 7089/7090 - 5
CTCB120…210(P)	DIN EN ISO 7089/7090 - 6
Tightening torque	
CTBC20…35 (P)	0.6 Nm
CTCB60…210(P)	1 Nm

Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Flammability class	UL94 V-0
Software	D0610
Documentation number	D00372
Weight	
RCMB301	≤ 100 g
CTBC20	≤ 160 g
CTBC20P	≤ 220 g
CTBC35	≤ 240 g
CTBC35P	≤ 320 g
CTBC60	≤ 460 g
CTBC60P	≤ 620 g
CTBC120	≤ 1390 g
CTBC120P	≤ 1750 g
CTBC210	≤ 4220 g
CTBC210P	≤ 4870 g

( )* Factory setting

The use of the power supply units listed at “Accessories” is recommended.
The use of a surge protection device is mandatory for these power supply units.

Ordering details

Evaluation electronics

Supply voltage U_s	Variant	Type	Art. No.
DC			
24 V (19.2…28.8 V)	Modbus RTU	RCMB301	B74043100

Required terminals are included in the scope of delivery.

Measuring current transformers

Internal diameter	Type	Art. No.
20 mm	CTBC20	B98120001
	CTBC20P	B98120002
35 mm	CTBC35	B98120003
	CTBC35P	B98120004
60 mm	CTBC60	B98120005
	CTBC60P	B98120006
120 mm	CTBC120	B98120007
	CTBC120P	B98120020
210 mm	CTBC210	B98120008
	CTBC210P	B98120021

P = full magnetic shield

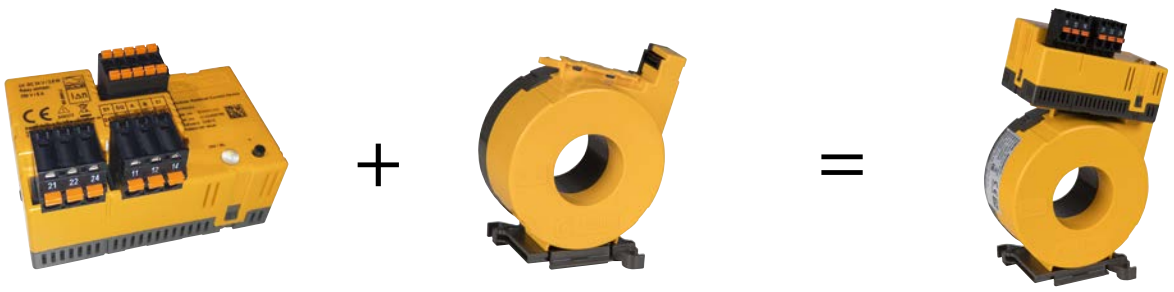
Accessories

Description	Art. No.
Interface converter USB to RS-485	B95012045
Terminal block for RCMB301 module	B74043124

Suitable system components

Description	max. connected current transformers	Type	Art. No.
Voltage supply	4	STEP-PS/1 AC/24 DC/0.5	B94053110
	14	STEP-PS/1 AC/24 DC/1.75	B94053111
	34	STEP-PS/1 AC/24 DC/4.2	B94053112

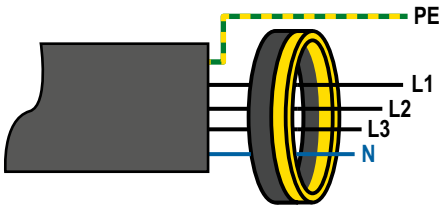
Example for the composition of an RCMB module



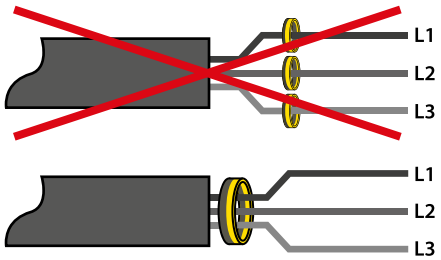
Evaluation unit: RCMB301 **Measuring current transformer: CTBC35** **Final RCMB module**

Installation instructions

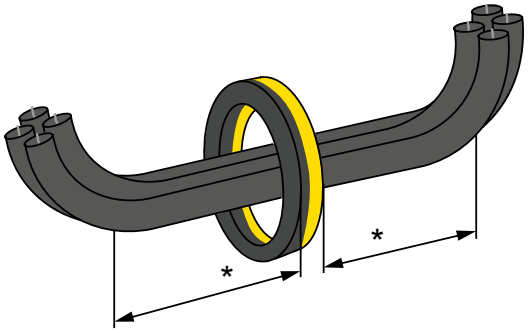
- Do not route any shielded cables through the measuring current transformer.
- Existing protective conductors and low-resistance conductor loops must not be routed through the measuring current transformer! Otherwise, high currents could be induced into the conductor loop due to the AC/DC sensitive measuring technology used.



Never route an existing protective conductor through the measuring current transformer.

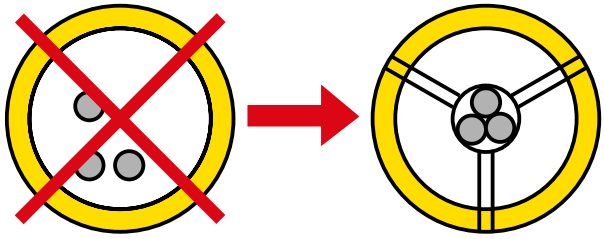


All current-carrying cables must be routed through the measuring current transformer.



* Distance to 90° angle: 2x external diameter of the current transformer

The primary conductors may only be bent from the specified minimum distance. The minimum bending radius specified by the manufacturers for the conductors used must be observed.



The cables must be aligned with the centre of the measuring current transformer.

optec
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